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(54) **VEHICLE EVENT RECORDER SYSTEMS AND NETWORKS HAVING INTEGRATED CELLULAR WIRELESS COMMUNICATIONS SYSTEMS**

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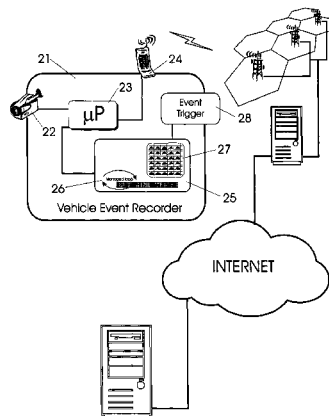
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(57) **ABSTRACT**

Vehicle event recorder systems are arranged to be in constant communication with remote servers and administrators via mobile wireless cellular networks. Vehicle event recorders equipped with video cameras capture video and other data records of important events relating to vehicle use. These data are then transmitted over special communications networks having very high coverage space but limited bandwidth. A vehicle may be operated over very large region while maintaining continuous communications connections with a remote fixed server. As such, systems of these inventions may be characterized as including a mobile unit having: a video camera; a microprocessor; memory; an event trigger; and mobile wireless transceivers, and a fixed network portion including: mobile wireless cellular network, a protocol translation gateway, the Internet and an application-specific server.

16 Claims, 5 Drawing Sheets

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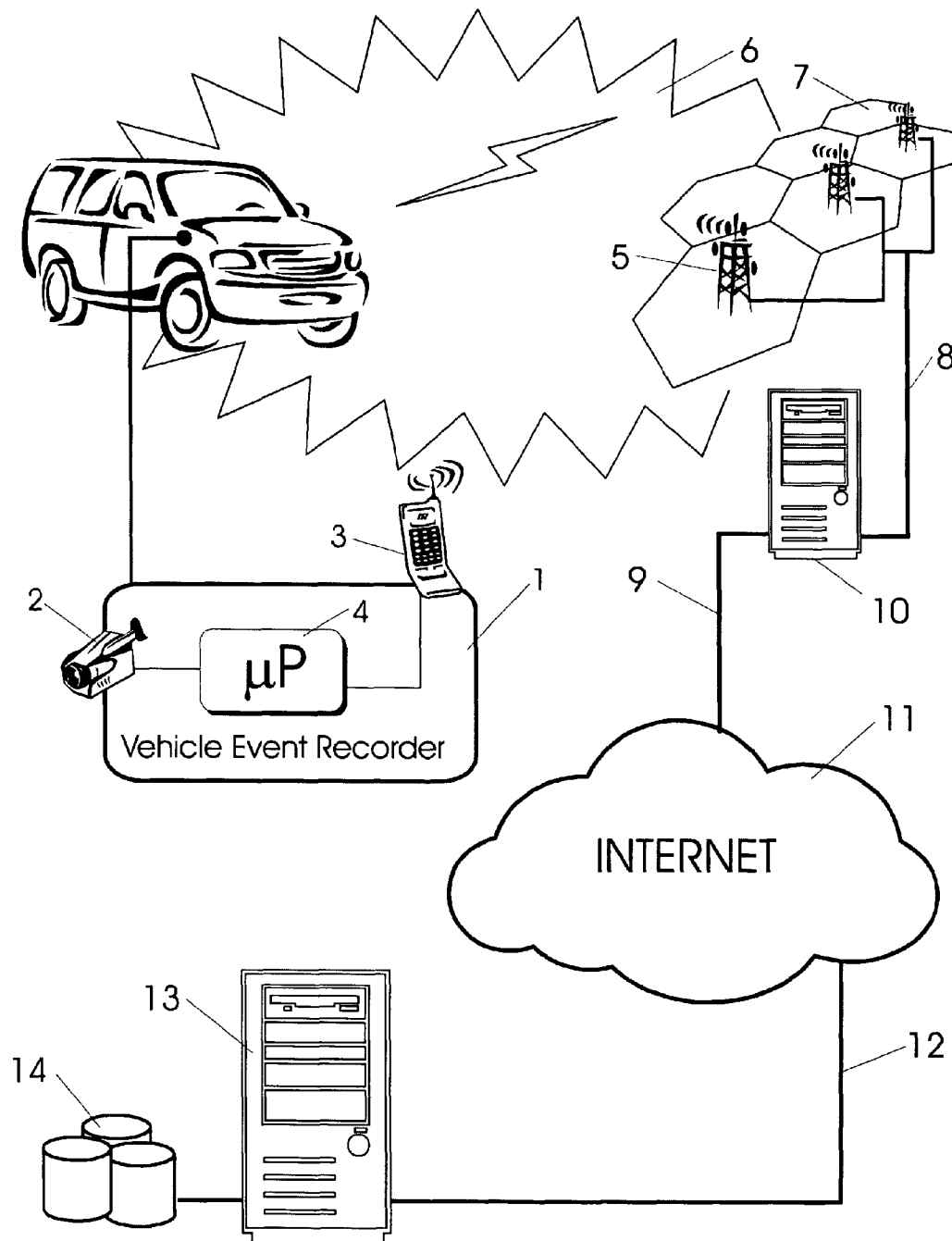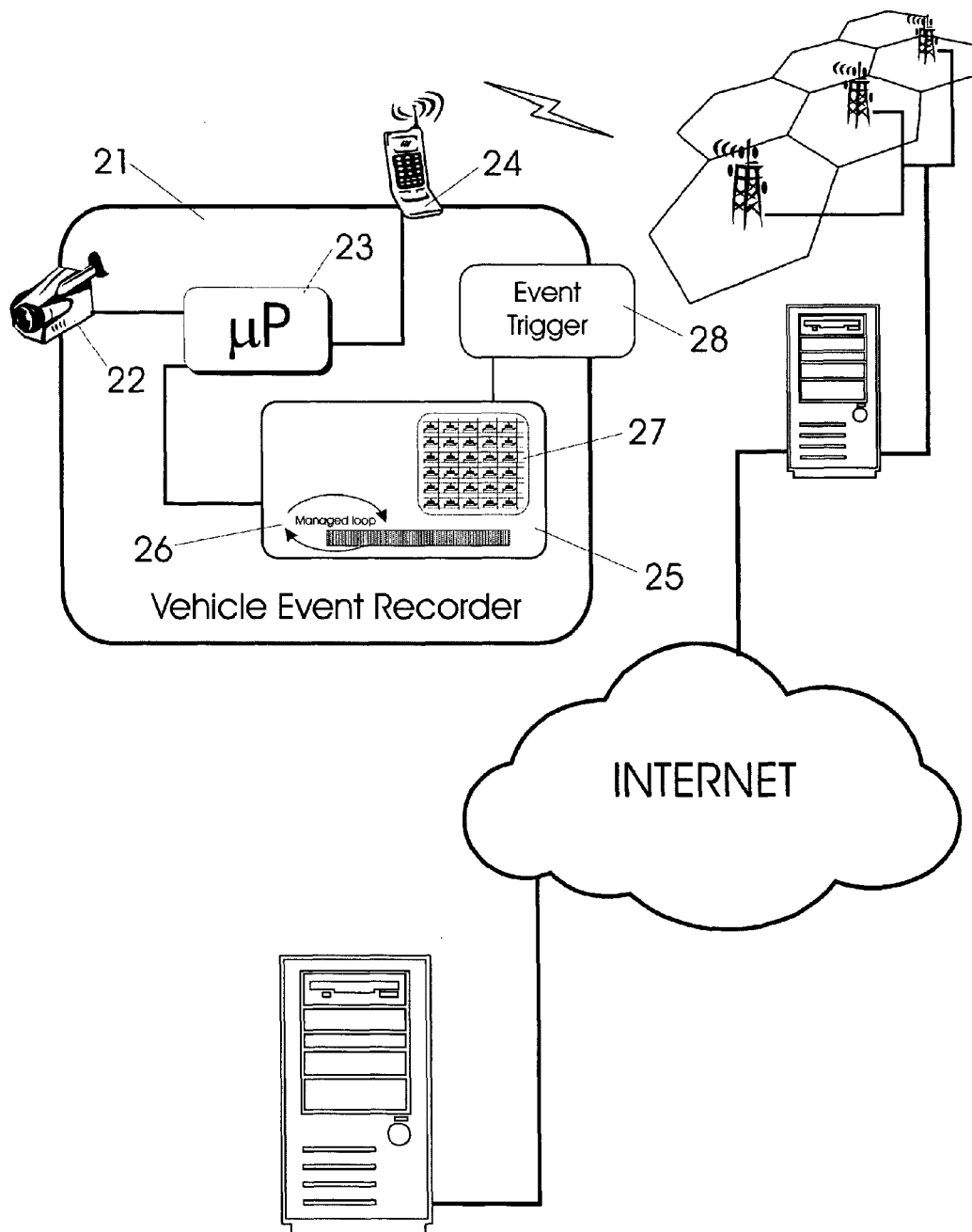
μP

Vehicle Event Recorder

INTERNET

Fig. 1

21

23

24

μP

22

Event
Trigger

28

27

Managed loop

26

25

Vehicle Event Recorder

INTERNET

Fig. 2

33

38

32

Dataset
Manager   36

μP

34

37

35

Vehicle Event Recorder

31

INTERNET

39

Fig. 3

44

41

Vehicle Event Recorder
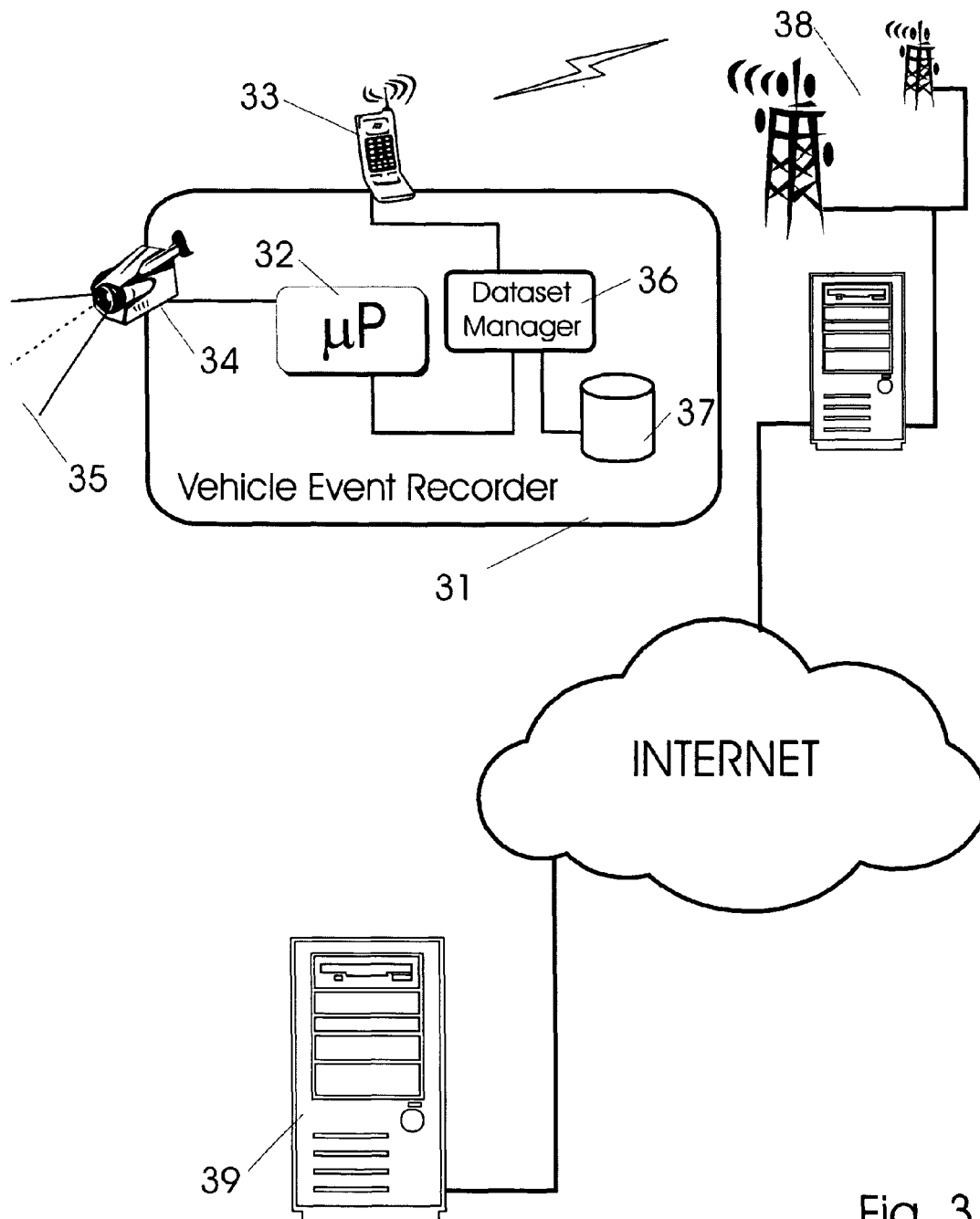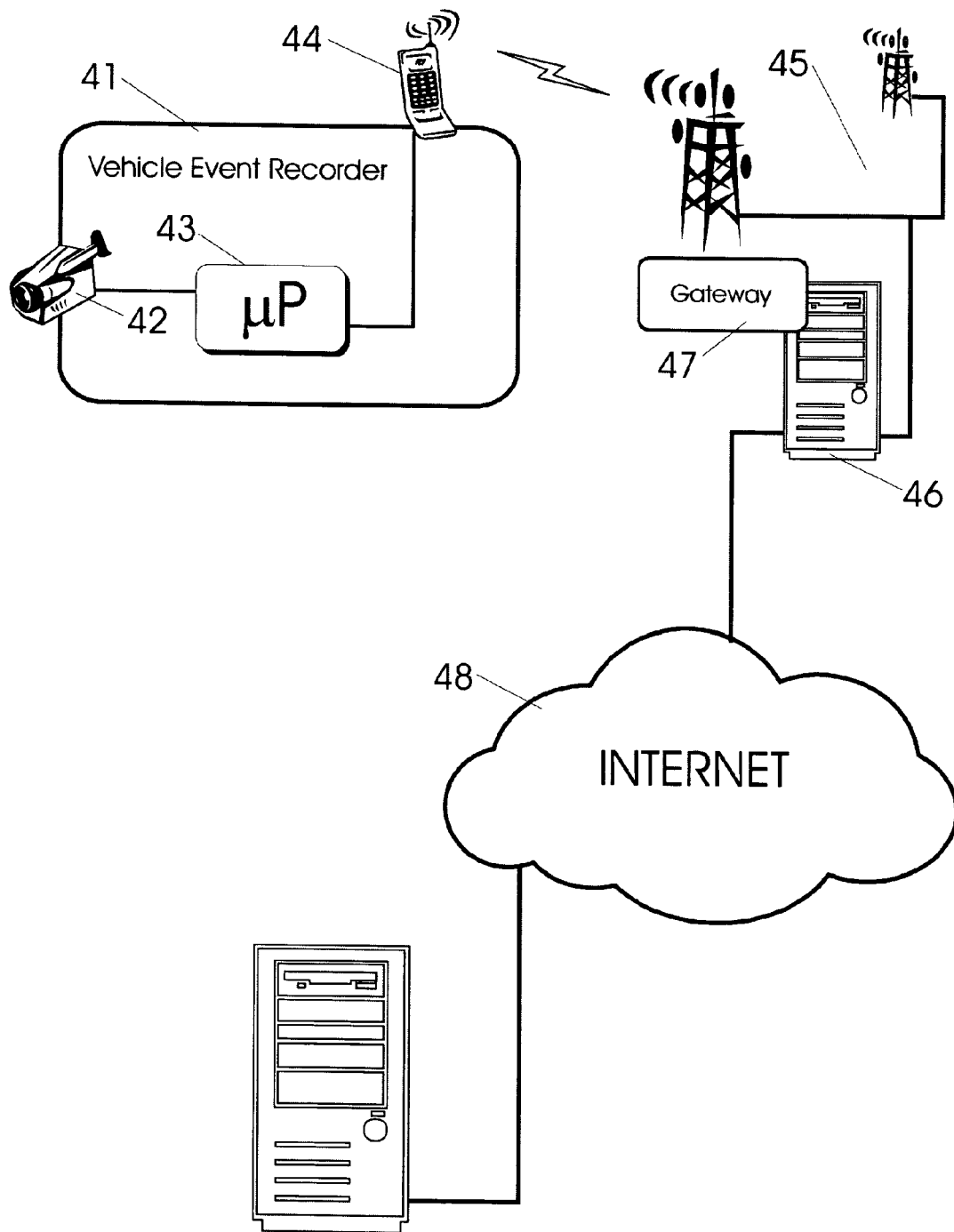
43
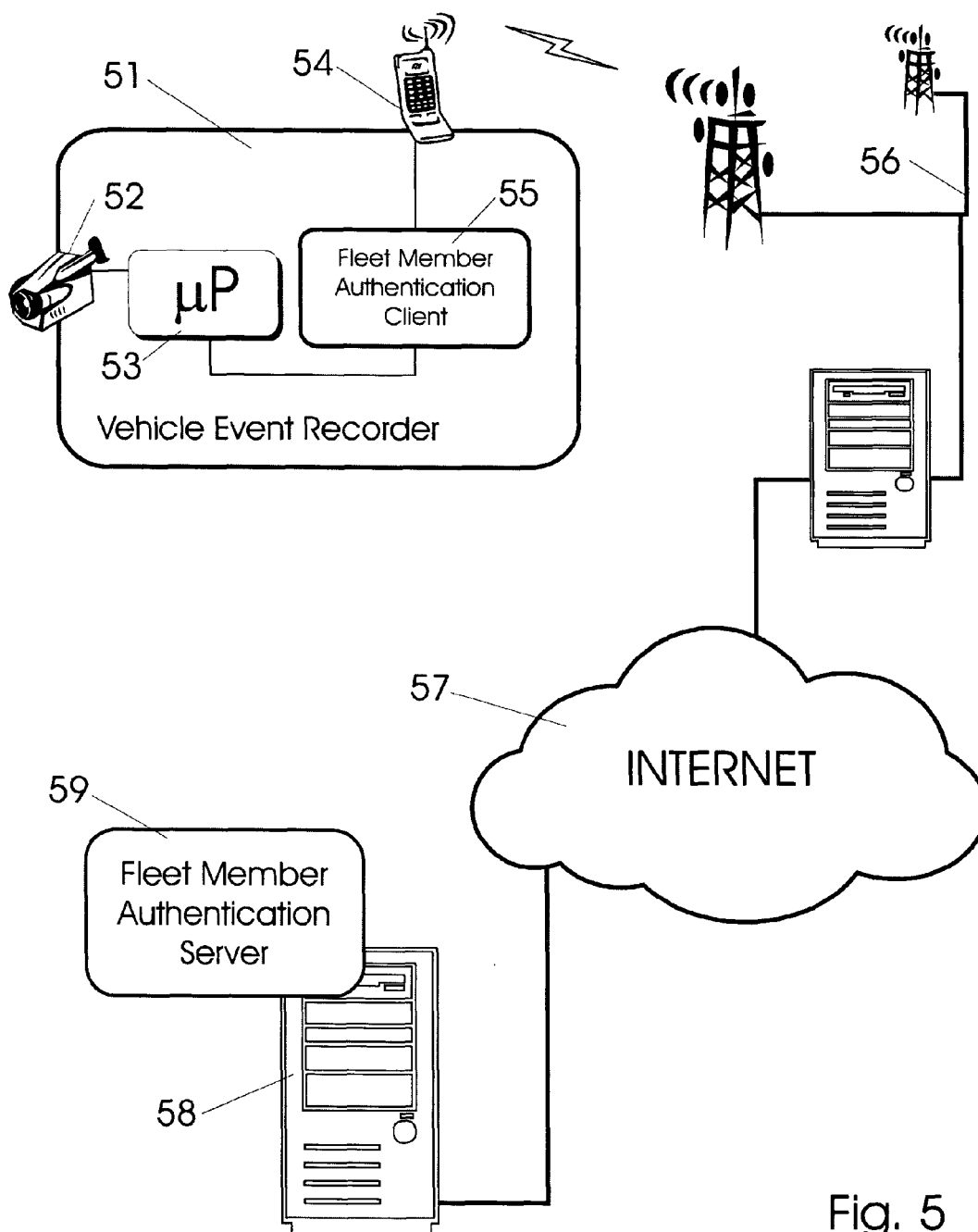
μP

42

45

Gateway

47

46

48

INTERNET

Fig. 4

Fig. 5

VEHICLE EVENT RECORDER SYSTEMS AND NETWORKS HAVING INTEGRATED CELLULAR WIRELESS COMMUNICATIONS SYSTEMS

BACKGROUND OF THESE INVENTIONS

1. Field

The following inventions disclosure is generally concerned with vehicle event recorder systems and specifically concerned with vehicle event recorder systems having cellular wireless transceivers which couple with wireless communications networks.

2. Prior Art

The inventions presented in U.S. Pat. No. 6,947,817 by inventor Diem for nonintrusive diagnostic tools for testing oxygen sensor operation relates to a diagnostic system for testing a vehicle where such systems include a wireless communications link between a vehicle any remote network of server computers. In particular, a WiFi type access points allowed an analyzer to communicate by way the Internet with a server computer hosting and oxygen sensor SOAP (simple object access protocol) service. In a nutshell, the system relates to smog sensors for automobiles which communicate with remote servers by way of a WiFi communications links.

Video surveillance systems are used to provide video records of events, incidents, happenings, et cetera in locations of special interest. For example, retail banking offices are generally protected with video surveillance systems which provide video evidence in case of robbery. While video surveillance systems are generally used in fixed location scenarios, mobile video surveillance systems are also commonly used today.

In particular, video systems have been configured for use in conjunction with an automobile and especially for use with police cruiser type automobiles. As a police cruiser is frequently quite near the scene of an active crime, important image information may be captured by video cameras installed on the police cruiser. Specific activity of interest which may occur about an automobile is not always associated with crime and criminals. Sometimes events which occur in the environments immediately about an automobile are of interest for reasons having nothing to do with crime. In example, a simple traffic accident where two cars come together in a collision may be the subject of video evidence of value. Events and circumstances leading up to the collision accident may be preserved such that an accurate reconstruction can be created. This information is useful when trying come to a determination as to cause, fault and liability. As such, general use of video systems in conjunction with automobiles is quickly becoming an important tool useful for the protection of all. Some examples of the systems are illustrated below with reference to pertinent documents.

Inventor Schmidt presents in U.S. Pat. No. 5,570,127, a video recording system for a passenger vehicle, namely a school bus, which has two video cameras one for an inside bus view and one for a traffic view, a single recorder, and a system whereby the two cameras are multiplexed at appropriate times, to the recording device. A switching signal determines which of the two video cameras is in communication with the video recorder so as to view passengers on the passenger vehicle at certain times and passing traffic at other times.

Thomas Doyle of San Diego, Calif. and QUALCOMM Inc. also of San Diego, present an invention for a method and apparatus for detecting fault conditions in a vehicle data

recording device to detect tampering or unauthorized access, in U.S. Pat. No. 5,586,130. The system includes vehicle sensors for monitoring one or more operational parameters of the vehicle. The fault detection technique contemplates storing a current time value at regular intervals during periods in which the recording device is provided with a source of main power. Inventor Doyle also teaches in the U.S. Pat. No. 5,815,071, a method and apparatus for monitoring parameters of vehicle electronic control units.

A "computerized vehicle log" is presented by Dan Kikinis of Saratoga Calif. in U.S. Pat. No. 5,815,093. The vehicle accident recording system employs a digital camera connected to a controller in nonvolatile memory, and an accident sensing interrupter. The oldest memory is overwritten by the newest images, until an accident is detected at which time the memory is blocked from further overwrites to protect the more vital images, which may include important information about the accident. Mr Kikinis instructs that in preferred embodiments, the system has a communications port whereby stored images are downloaded after an accident to a digital device capable of displaying images. This feature is described in greater detail in the specification which indicates a wired download to a server having specialized image handling and processing software thereon.

Inventor Mr. Turner of Compton, Calif., no less, teaches an antitheft device for an automotive vehicle having both an audible alarm and visual monitor system. Video monitor operators are responsible for monitoring and handling an emergency situation and informing a 911 emergency station. This system is presented in U.S. Pat. No. 6,002,326.

A vehicle accident video recorder, in particular, a railroad vehicle accident video recorder, is taught by inventors Cox et al. In this system, a method and monitoring unit for recording the status of the railroad vehicle prior to a potential accident is presented. The monitoring unit continuously monitors the status of an emergency brake of the railroad vehicle and the status of a horn of the railroad vehicle. Video images are recorded and captured for a predetermined period of time after detecting that the emergency brake or horn blast has been applied as an event trigger. This invention is the subject of U.S. Pat. No. 6,088,635.

A vehicle crash data recorder is presented by inventor Ferguson of Bellaire, Ohio in U.S. Pat. No. 6,185,490. The apparatus is arranged with a three stage memory to record and retain information. And further it is equipped with a series and parallel connectors to provide instant on-scene access to accident data. It is important to note that Ferguson finds it important to include the possibility of on-site access to the data. Further, that, Ferguson teaches use of a wired connection in the form of a serial or parallel hardwire connector. This teaching of Ferguson is common in many advanced systems configured as vehicle event recorders.

A traffic accident data recorder and traffic accident reproduction system and method is presented as U.S. Pat. No. 6,246,933. A plurality of sensors for registering vehicle operation parameters including at least one vehicle mounted digital video, audio camera is included for sensing storing and updating operational parameters. A rewritable, nonvolatile memory is provided for storing those processed operational parameters and video images and audio signals, which are provided by the microprocessor controller. Data is converted to a computer readable form and read by a computer such that an accident can be reconstructed via data collected.

U.S. Pat. No. 6,298,290 presented by Abe et al, teaches a memory apparatus for vehicle information data. A plurality of sensors including a CCD camera collision center of vehicle speed sensors, steering angle sensor, brake pressure

sensor, acceleration sensor, are all coupled to a control unit. Further, the control unit passes information to a flash memory and a RAM memory subject to an encoder. The information collected is passed through a video output terminal. This illustrates another hardwire system and the importance placed by experts in the art on a computer hardware interface. This is partly due to the fact that video systems are typically data intensive and wired systems are necessary as they have bandwidth sufficient for transfers of large amounts of data.

Mazzilli of Bayside, N.Y. teaches in U.S. Pat. No. 6,333, 759 a 360° automobile video camera system. A complex mechanical mount provides for a single camera to adjust its viewing angle giving a 360° range for video recording inside and outside of an automotive vehicle.

U.S. Pat. No. 6,389,339 granted to Inventor Just, of Alpharetta, Ga. teaches a vehicle operation monitoring system and method. Operation of a vehicle is monitored with an onboard video camera linked with a radio transceiver. A monitoring service includes a cellular telecommunications network to view a video data received from the transceiver to a home-base computer. These systems are aimed at parental monitoring of adolescent driving. The mobile modem is designed for transmitting live video information into the network as the vehicle travels.

Morgan, Hausman, Chilek, Hubenak, Kappler, Witz, and Wright with their heads together invented an advanced law enforcement and response technology in U.S. Pat. No. 6,411,874 granted Jun. 25, 2002. A central control system affords intuitive and easy control of numerous subsystems associated with a police car or other emergency vehicle. This highly integrated system provides advanced control apparatus which drives a plurality of detector systems including video and audio systems distributed about the vehicle. A primary feature included in this device includes an advanced user interface and display system, which permits high level driver interaction with the system.

Inventor Lambert teaches in U.S. Pat. No. 6,421,080 a "digital surveillance system with pre-event recording". Pre-event recording is important in accident recording systems, because detection of the accident generally happens after the accident has occurred. A first memory is used for temporary storage. Images are stored in the temporary storage continuously until a trigger is activated which indicates an accident has occurred at which time images are transferred to a more permanent memory.

Systems taught by Gary Rayner in U.S. Pat. Nos. 6,389, 340; 6,405,112; 6,449,540; and 6,718,239, each directed to cameras for automobiles which capture video images, both of forward-looking and driver views, and store recorded images locally on a mass storage system. An operator, at the end of the vehicle service day, puts a wired connector into a device port and downloads information into a desktop computer system having specialized application software whereby the images and other information can be played-back and analyzed at a highly integrated user display interface.

It is not possible in the systems Rayner teaches for an administrative operator to manipulate or otherwise handle the data captured in the vehicle at an off-site location without human intervention. It is necessary for a download operator to transfer data captured from the recorder unit device to a disconnected computer system. While proprietary 'Drive-Cam' files can be e-mailed or otherwise transferred through the Internet, those files are in a format with a can only be digested by desktop software running at a remote computer. It is necessary to have the DriveCam desktop application on

the remote computer. In order that the files be properly read. In this way, data captured by the vehicles is totally unavailable to some parties having an interest in the data. Namely those parties who do not have access to a computer appropriately arranged with the specific DriveCam application software. A second and major disadvantage is systems presented by Rayner includes necessity that a human operator service the equipment each day in a manual download action.

Remote reporting and manipulation of automobile systems is not entirely new. The following are very important teachings relating to some automobile systems having a wireless communications link component.

Inventors Fan et al, teach inventions of methods and systems for detecting vehicle collision using global positioning system GPS. The disclosure of Jun. 12, 2001 resulted in granted patent having U.S. Pat. No. 6,459,988. A GPS receiver is combined with wireless technology to automatically report accident and third parties remotely located. A system uses the GPS signals to determine when an acceleration value exceeds the preset threshold which is meant to be indicative of an accident having occurred.

Of particular interest include inventions presented by inventors Nagda et al., in the document numbered U.S. Pat. No. 6,862,524 entitled using location data to determine trafficking route information. In this system for determining and disseminating traffic information or route information, traffic condition information is collected from mobile units that provide their location or position information. Further route information may be utilized to determine whether a mobile unit is allowed or prohibited from traveling along a certain route.

A common assignee, @Road Inc., owns the preceding two patents in addition to the following: U.S. Pat. Nos. 6,529, 159; 6,552,682; 6,594,576; 6,664,922; 6,795,017; 6,832, 140; 6,867,733; 6,882,313; and 6,922,566. As such, @Road Inc., must be considered a major innovator in position technologies arts as they relate to mobile vehicles and remote server computers.

General Motors Corp. teaches in U.S. Pat. No. 6,728,612, an automated telematics test system and method. The invention provides a method and system testing a telematics system in a mobile vehicle a test command from a test center to a call center is based on a test script. The mobile vehicle is continuously in contact by way of cellular communication networks with a remotely located host computer.

Inventor Earl Diem and Delphi Technologies Inc., had granted to them on Sep. 20, 2005, U.S. Pat. No. 6,947,817. The nonintrusive diagnostic tool for sensing oxygen sensor operation include a scheme or an oxygen analyzer deployed in a mobile vehicle communicates by way of an access point to a remotely located server. A diagnostic heuristic is used to analyze the data and confirm proper operation of the sensor. Analysis may be performed by a mainframe computer quickly note from the actual oxygen sensor.

Similar patents including special relationships between mobile vehicles and remote host computers include those presented by various inventors in U.S. Pat. Nos. 6,735,503; 6,739,078; 6,760,757; 6,810,362; 6,832,141; and 6,850,823.

Another special group of inventions owned by Reynolds and Reynolds Holding Inc., is taught first by Lightner et al, in U.S. Pat. No. 6,928,348 issued Aug. 9, 2005. In these inventions, Internet based emission tests are performed on vehicles having special wireless couplings to computer networks. Data may be further transferred to entities of particular interest including the EPA or California Air

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Resources Board, for example, or particular insurance companies and other organizations concerned with vehicle emissions and environment.

Other patents held by Reynolds and Reynolds Holding Inc., include those relating to reporting of automobile performance parameters to remote servers via wireless links. Specifically, an onboard data bus OBD system is coupled to a microprocessor, by way of a standard electrical connector. The microprocessor periodically receives data and transmits it into the wireless communications system. This information is more fully described in U.S. patent granted Oct. 21, 2003 U.S. Pat. No. 6,636,790. Inventors Lightner et al, present method and apparatus for remotely characterizing the vehicle performance. Data at the onboard data by his periodically received by a microprocessor and passed into a local transmitter. The invention specifically calls out transmission of data on a predetermined time interval. Thus these inventions do not anticipate nor include processing and analysis steps which result in data being passed at time other than expiration of the predetermined time period.

Reynolds and Reynolds Holding Inc., further describes systems where motor vehicles are coupled by wireless communications links to remote host servers in U.S. Pat. No. 6,732,031.

While systems and inventions of the arts are designed to achieve particular goals and objectives, some of those being no less than remarkable, these inventions have limitations which prevent their use in new ways now possible. Inventions of the art are not used and cannot be used to realize the advantages and objectives of the inventions taught herefollowing.

SUMMARY OF THESE INVENTIONS

Comes now, James Plante with inventions of vehicle event recorder systems. having integrated cellular wireless communications links.

Vehicle event recorders including those provided with imaging means, are arranged to monitor vehicle use and to collect images of scenes occurring about the vehicle's environments among other vehicle performance and use data. Further, these systems are arranged to collect data associated with a particular moment in time, or an "event" and to preserve that data for post event review.

In accordance with some preferred versions of these inventions, a detailed or 'complete' dataset is parsed, compressed and otherwise reduced into a data subset of limited size. Thus, an "abbreviated" dataset is a data subset which may be more readily transmitted on limited bandwidth systems. While an abbreviated dataset is passed into the network in near real time, a complete dataset may be preserved locally for transmission at a later time when a higher bandwidth link becomes available.

As such, vehicle event recorder systems of these inventions are deployed in conjunction with wireless mobile telephone type communications networks. A video camera, vehicle systems transducers, and other measurement systems associated with vehicle use all operate to collect data during the service use of a vehicle. On the occurrence of an "event", for example, a traffic accident, data is captured and preserved in a special onboard memory. Further, a parsing module is provided to extract the most important information which may be represented in a dataset of reduced size. Accordingly, these systems may be characterized in summary as including vehicle event recorders with a video camera, microprocessor, memory, parsing module, and a mobile wireless communications transceiver; further, those

vehicle event recorders in communication with a mobile wireless base station, gateway, Internet and remote application specific server.

Objectives of These Inventions

It is a primary object of these inventions to provide new vehicle fleet management tools.

It is an object of these inventions to provide vehicle fleet management systems having a video component.

It is a further object to provide vehicle fleet management systems arranged with high performance mobile network connectivity and function.

It is an object of these inventions to provide video based vehicle fleet management systems in conjunction with ubiquitous, always-on, mobile wireless networks.

An object of these inventions includes provision of video based vehicle fleet management systems in conjunction with cellular type wireless networks.

A better understanding can be had with reference to detailed description of preferred embodiments and with reference to appended drawings. Embodiments presented are particular ways to realize these inventions and are not inclusive of all ways possible. Therefore, there may exist embodiments that do not deviate from the spirit and scope of this disclosure as set forth by appended claims, but do not appear here as specific examples. It will be appreciated that a great plurality of alternative versions are possible.

BRIEF DESCRIPTION OF THE DRAWING FIGURES

These and other features, aspects, and advantages of the present inventions will become better understood with regard to the following description, appended claims and drawings where:

FIG. **1** is a schematic diagram of vehicle event recorder systems including a vehicle event recorder in relation with a compound network;

FIG. **2** is a diagram including special detail relating to memory management;

FIG. **3** presents in block diagram, versions of these systems along with special interfaces between some primary system elements;

FIG. **4** diagrams some important secondary elements; and finally

FIG. **5** illustrates a block schematic with specially arranged authentication clients/servers.

GLOSSARY OF SPECIAL TERMS

Throughout this disclosure, reference is made to some terms which may or may not be exactly defined in popular dictionaries as they are defined here. To provide a more precise disclosure, the following terms are presented with a view to clarity so that the true breadth and scope may be more readily appreciated. Although every attempt is made to be precise and thorough, it is a necessary condition that not all meanings associated with each term can be completely set forth. Accordingly, each term is intended to also include its common meaning which may be derived from general usage within the pertinent arts or by dictionary meaning. Where the presented definition is in conflict with a dictionary or arts definition, one must consider context of use and provide liberal discretion to arrive at an intended meaning. One will be well advised to error on the side of attaching broader meanings to terms used in order to fully appreciate the entire depth of the teaching and to understand all intended variations.

Cellular Wireless Communications Networks

The term 'cellular wireless communications networks' is intended to include those wireless networks having large coverage areas comprised of cells which further include 'handoff' mechanisms for nodes passing from one cell to another whereby a continuous connection is maintained.

Gateway

A 'gateway' is a coupling system used to interface together two independent systems whereby a protocol used on a first system is translated into a protocol used on a second system.

Managed Loop Memory

A 'managed loop memory' is a memory system arranged to preserve in detail data captured during a period immediately past with respect to any instant but to overwrite that data with newer data when that data has sufficiently aged in accordance with a predefined expiration definition.

Vehicle Environments

The environment in and about a vehicle includes those spaces interior or exterior with respect to the car body. That is to say, traffic ahead of, behind, towards the sides of, and inside the driver compartment are all included as vehicle environments.

Communications Port

Includes for example: cellular transceiver; WiFi; Network Interface card; serial port such as RS-232; among others.

PREFERRED EMBODIMENTS OF THESE INVENTIONS

In accordance with each of preferred embodiments of these inventions, vehicle event recorders with integrated cellular wireless communications systems are provided. It will be appreciated that each of embodiments described include an apparatus and that the apparatus of one preferred embodiment may be different than the apparatus of another embodiment presented in an alternative example.

Combinations of vehicle event recorders coupled with mobile telephone communications networks, the Internet, and special application-specific servers and databases form the basis of best modes of these inventions. In particular, a vehicle event recorder is comprised of a video camera, a mobile wireless type radio transceiver and microprocessor. The video camera is arranged to have a field-of-view including environments about a vehicle in which the recorder is installed—generally a forward-looking viewpoint and sometimes a vehicle driver compartment viewpoint. The video camera runs continuously while a vehicle is in use capturing images of scenes occurring about the vehicle. In the event of a traffic accident or some other physical anomaly, a video series including frames from before and after the accident are captured by way of a special memory management system. A microprocessor is electronically coupled to the mobile telephone transceiver whereby it can transmit/receive data to/from further into a network where it may couple with a remote server running application specific software. The wireless transceiver operates to convert electronic signals from the microprocessor into electromagnetic signals for free space transmission. These electromagnetic signals are received at either of the base stations belonging to the spatially distributed cells and converted back into electronic signals. Those electronic signals may be further transmitted via packet networks to remote servers for additional analysis and processing.

While vehicle event recorder arrangements have been suggested in conjunction with wireless communications networks, namely in U.S. patent application Ser. No. 11/299,

028, that disclosure is hereby incorporated herein by explicit reference, those systems are limited with respect to the space in which download actions can be executed. In those systems, a vehicle performs its assigned service and thereafter returns to a download location; i.e. the vehicle enters a specially arranged space such that the vehicle is near to a WiFi transceiver base station or 'access point'. Such proximity condition is detected, and in response to detection of that condition a data transfer action causes data to be passed to the remote server. These systems require a vehicle to return to an approved download space in order that an authorized network connection be made. It is generally not possible to transfer data while the vehicle is active in the duty of its assignment.

In the present inventions, it is a primary feature that a vehicle is in continuous contact with the remote server while it is being used over extremely large regions. This is possible because a vehicle event recorder is coupled to a remoter server via links arranged in wireless cellular communications networks. These are quite distinct from previous wireless networks as they are formed of a great plurality of cooperating base stations well distributed to provide continuous coverage over extended area. A plurality of transmitters each spatially removed from another, each having a communication range which forms a partial overlap with the communication range of at least one other defines a coverage space, the extent of said coverage space being at least a few tens of cubic miles. Further distinction with regard to WiFi wireless systems which may include a plurality of transmitters all coupled to form a single network, cellular networks, more specifically those arranged as mobile telephone systems, include special handoff mechanisms whereby a mobile transceiver which passes from one cell to another cell maintains a seemingly continuous connection. In this way, the coverage space in which a connection may be maintained to extend over many hundreds of square miles.

To further improve range, wireless systems arranged as cellular networks use electromagnetic radiation of particular frequency and specialized antennae suitable for long-range transmissions. These electromagnetic signals are arranged, both in frequency and protocol, to cooperate with common mobile telecommunications networks. For example, these signals may be arranged in the frequency band between about 750 MHz and 2000 MHz. Some common cellular networks are build about the frequency bands having a center frequency at 900 MHz or 1800 MHz. For example, in a GSM frequency band is divided into 124 carrier frequencies, or subbands, spaced 200 kHz apart in a frequency division multiple access FDMA scheme. Each subband may be further divided into a time-sharing scheme, or TDMA time division multiple access system.

As the particular nature of vehicle event recorder systems and their use in fleet vehicles demands network connections which may be maintained continuously over very large ranges, the combination of a vehicle event recorder head with a cellular type wireless network should be viewed as particularly beneficial and cooperative in a synergistic way. The combination of vehicle event recorders with wireless cellular networks provides fantastic benefit. Among which includes continuing communication between a remote server and a vehicle during a service today. However, this combination is also accompanied by some disadvantage. The bandwidth of wireless cellular networks is not sufficiently adequate whereby high-resolution real-time video may be uploaded from an in-vehicle system. Accordingly, it is sometimes necessary to provide special means for forming

datasets of reduced size which may be more readily transmitted over limited bandwidth networks such as common wireless cellular networks.

In a first of such systems, a vehicle event recorder head includes a local memory which is well managed in view of an overwrite scheme which discards unnecessary data of low value while preserving high value data for transmission to the remote server. In other systems, a complete dataset may be abbreviated with the abbreviated portion subject to instant transmission and the complete dataset subject to non real-time transmission, but rather subject to a delayed transmission at times when network resources become more available. Thus, a high priority dataset and lower priority dataset may be formed in conjunction with a single event. The high priority dataset is of limited or reduced size and subject to instant transmission, the low priority dataset may be considerably larger but more permissive with respect to transmission delay.

These concepts and others are more readily understood in view of the following discussion with reference to numerals which is directed to FIGS. 1 through 5. Particularly, the diagram of FIG. 1 illustrates vehicle event recorder systems in a schematic presentation. A vehicle event recorder head 1, includes as primary elements a video camera 2, a wireless communications transceiver 3, and a computer micropro-cessor 4. These elements arranged in a common housing may be mounted conveniently within a vehicle for example, on the interior, near the dashboard behind the windshield. The combination including: a video camera; processor; mobile wireless communications link, prepared as a single unit suitable for integration with the vehicle is sometimes and herein called a 'vehicle event recorder head' or the 'head unit'. So long as a vehicle remains within the coverage space of the cellular network, images collected by the video camera may be processed by the microprocessor and transmitted through the cellular network to remote servers. A distribution of various cellular base stations 5 forms a coverage space 6 which may extend many tens of cubic miles. A plurality of these base stations operate in conjunction with one another by way of 'handoff mechanisms to form the 'cellular' arrangement 7. A vehicle passing from one cell to another cell seamlessly transfers communication from a first a base station to a second base station without ever having lost connection 8 to the network. In this way, data from a vehicle event recorder may be continuously transferred into the network even at times when a vehicle passes from a first cell to another. Thus very large continuous coverage areas are provided such that a vehicle event recorder mounted in a vehicle is continuously in contact with a remote server throughout the service day. Such advantage cannot be available in wired or fixed wireless systems having in comparison—severely limited range.

It is important to point out that an arrangement of these architectures includes a protocol translator between those communications protocols of wired networks and those communications protocols preferred on mobile wireless networks. Thus these vehicle event recorder systems may be considered as including a compound communications network comprised of a wireless side 8 and a wired side 9 with a protocol translator or 'gateway' 10 there between. Further these compound networks may also include the Internet 11 which may be connected 12 to remote server 13, and still further to a mass storage database 14.

Experts in the field will surely appreciate that a high-resolution video camera generates far too much data than which can be transmitted in real-time over a common wireless mobile cellular communications network. It is for

this reason that in some versions a special memory system be adopted whereby high-resolution video can be collected and pre-processed before transmission over the wireless link. In a first scheme, a managed loop memory is arranged to receive video frames while simultaneously discarding older frames in accordance with a strategy which preserves most valuable data. Since only most valuable' data is transmitted, a limited communications link is not totally consumed by an unprocessed video stream.

In FIG. 2 it can be it further appreciated that a vehicle event recorder head 21 is comprised of a video camera 22, a microprocessor 23, a wireless mobile communications transceiver 24, an advanced two-stage memory 25 comprising a managed-loop memory 26, and a flash-type memory buffer 27. Although video is continuously captured by the video camera and transferred to the managed loop memory portion, only on a toggle action of the event trigger 28 is data transferred from the loop to the flash memory buffer. The data set which is transferred to the flash memory buffer, may be considerably reduced in size when compared to an unprocessed continuous video stream. One will gain a further appreciation of these memory management arrangements, which are fully disclosed in detail in U.S. patent application filed Dec. 7, 2005 entitled: "Memory Management in Event Recording Systems" which is hereby incorporated into this disclosure by explicit reference.

While memory management techniques described above are considered preferred best modes, is explicitly noted and anticipated herein that many other schemes might be usefully deployed to reduce a continuous data stream collected by a video camera to an abbreviated dataset more suitable for transmission over limited bandwidth communications links. Accordingly, we consider a system architecture depicted in FIG. 3. A vehicle event recorder head 31 is comprised of the microprocessor 32, communications transceiver 33, video camera 34 having field of view 35, dataset manager 36, and mass data storage buffer 37. The dataset manager is arranged to receive video data and to process received data to produce an abbreviated dataset which has a reduced amount of data in comparison to a data heavy continuous video stream. Once a dataset manager produces an abbreviated dataset in the vehicle event recorder head, that abbreviated dataset may be transmitted by mobile communications transceiver into the cellular network 38, and further through a wired network and to remote server 39.

FIG. 4 illustrates another important element of these systems. Due to the specific physical nature of cellular communications networks, certain transmission protocols are required. However, wired networks have different characteristics, and thus different transmission protocols are used with those networks. When a compound network is formed of a wireless portion and a wired portion, a system must be put in place to translate from one protocol to another and perform the reverse operation for data traffic going in an opposing direction. This protocol translator is sometimes and herein called a 'gateway'. FIG. 4 illustrates a system having a gateway protocol translator between a wired portion and a wireless portion of a compound communications network. A vehicle event recorder head 41, includes video camera 42, microprocessor 43, and cellular transceiver 44. The cellular transceiver 44 may transmit and receive data messages in accordance with protocols used with wireless cellular networks such as W-CDMA, EvDO, GPRS, EDGE, PCS, CDMA, and GSM, among others.

Wireless cellular network 45 may include a base station 46. The base station may have special gateway module 47 arranged to translate protocols associated wireless networks

into protocols used more commonly with wired networks such as the Internet **48**. High speed wired type networks most commonly deploy transmission protocols such as those including: TCP/IP, UDP, XML, HTML data exchange formats among others. In this way, a vehicle event recorder system of these inventions includes a vehicle event recorder head in communication with a compound network including a wireless portion and a wired portion coupled together by way of a protocol gateway. In preferred versions, the wireless portion of these networks is arranged as a cellular mobile wireless network commonly used with mobile telephones. In preferred versions, the wired portion of the network includes the Internet which supports remote location and widely available access to a system server.

Finally, FIG. **5** illustrates yet another important feature of these systems. As these systems are primarily directed to vehicle fleet management strategy, fleet member authentication client and server modules are to be included as part of a vehicle event recorder head and remote server respectively. A fleet member authentication client is a module which provides handshaking and identification functionality such that a particular vehicle event recorder associated with a particular vehicle, or vehicle and user/driver, to present itself as such to the fleet member authentication server module. In this way, a single remote server may be in communication with a plurality of vehicles and groups of vehicles all associated with a particular vehicle fleet. The remote server can thereafter manage event data received from various vehicles and sort it as part of the particular fleet and further manage access to the data with regard to particular fleet administrator. In the figure, vehicle event recorder head **51**, includes video camera **52**, microprocessor **53**, and wireless transceiver **54**. In addition vehicle event recorder head is integrated with a fleet member authentication client module **55**. When in communication with a remote server, the authentication module presents an identity scheme which is transmitted by cellular network **56** and further by wired network **57**. The remote server **58** is integrated with a fleet member authentication server module **59**. Calls from particular vehicle event recorders are received by the server and processed in accordance with their association with a specific fleet known to the server.

While in general a vehicle event recorder head is arranged to automatically connect wirelessly to the network in response to an event trigger, other actions may be arranged to initiate a data transfers. One such action includes that which occurs remote from the vehicle event recorder head. A systems administrator might initiate a request for information from a particular vehicle while operating in the field. The request is transmitted from the remote server, and hits the vehicle event recorder head to trigger a data transfer in agreement with the request. The request may be for a 'present instant' dataset which is generated at a vehicle event recorder head in real-time. Alternatively the request may be for a dataset associated with a prior instant; that dataset having been stored in a local memory. In either case, these systems are meant to include data-transfer actions and which are initiated by an administrator operating from a remote server station or other remote location.

In some versions of these inventions, it is necessary throttle data transmission in accordance with network congestion considerations. When a wireless cellular telephone network is very busy, the system resources should be allocated to those applications which require real-time data exchange. For example, a voice conversation is a real-time application that requires receipt of data without delay. However in most instances, data collected by a vehicle event

recorder is not subject to compromise when it is received at a remote server with some reasonable delay. Accordingly, these systems are arranged such that the vehicle event recorder head is responsive in its data transmission activity as directed from an indicator provided by the network, the indicator being indicative of network capacity or network congestion. This function, among others may be taken up at a dataset manager.

While an 'Internet Server' is a general purpose server which can provide hosting and HTML response services to any requesting agent, the servers described here are not general purpose Internet servers. Rather, these servers include application-specific code. This code is particularly arranged with a view to support of vehicle event recorder systems. That is to say, servers are predefined in their function. Such that they are responsive to calls made by cooperating vehicle event recorder heads which have a priori knowledge of the existence of the server and the functions enabled therein. Thus proprietary calls and responses may be exchanged between an authorized vehicle event recorder head and a remote server suitable for receiving such calls from those authorized vehicle event recorders.

By way of example one such important function includes authentication services. In these systems, it is important that only authorized vehicle event recorder units be allowed to communicate with specific servers arranged to receive their communications. Thus both servers and vehicle event recorders are arranged with authentication modules. An authentication client is part of a vehicle event recorder unit; and an authentication server is part of the remote server suite of functionality. Thus, special relationships are formed between vehicle event recorders and associated remote servers. In this way, special fleet administration including fleet messaging may be established. Vehicle event recorders may operate in groups of cooperating units, these groups having further associations with entities such as business divisions or other logical groupings.

One will now fully appreciate how highly mobile vehicle event recorders are coupled to remote servers by way of wireless cellular communications networks to provide continuous links over greatly extended communications spaces. Although the present inventions have been described in considerable detail with clear and concise language and with reference to certain preferred versions thereof including best modes anticipated by the inventors, other versions are possible. Therefore, the spirit and scope of the invention should not be limited by the description of the preferred versions contained therein, but rather by the claims appended hereto.

What is claimed is:

1. A vehicle event recorder system comprising:

a video camera configured to capture image data, wherein the video camera has a field of view arranged to include an environment in and/or around a vehicle;

a communications transceiver configured to transmit information via a communication network to a server computer;

an electronic memory configured to electronically store information; and

a microprocessor configured to:

effectuate storage of captured image data in the electronic memory,

responsive to physical anomaly event triggers, create detailed complete datasets that correspond to individual physical anomaly event triggers, wherein the detailed complete datasets include image data captured by the video camera, wherein the physical anomaly event triggers include a particular indi-

vidual physical anomaly event trigger, and wherein the detailed complete datasets include a particular individual detailed complete dataset that corresponds to the particular individual physical anomaly event trigger;

create abbreviated datasets by parsing the detailed complete datasets such that the abbreviated datasets include less bytes of data than the corresponding detailed complete datasets, wherein the abbreviated datasets include a particular individual abbreviated dataset that has been created by parsing the particular individual detailed complete dataset such that the particular individual abbreviated dataset corresponds to the particular individual physical anomaly event trigger;

effectuate storage of the abbreviated datasets in the electronic memory, and

facilitate transmission of an individual one of the detailed complete datasets and the abbreviated datasets via the communications transceiver,

wherein the microprocessor is further configured to prioritize transmission of the abbreviated datasets over the detailed complete datasets such that the particular individual abbreviated dataset is transmitted without delay via the communication network, and subsequently the particular individual detailed complete dataset is transmitted via the communication network responsive to the amount of available bandwidth being sufficient to permit transmission of the particular individual detailed complete dataset.

2. The vehicle event recorder system of claim 1, wherein transmission of the particular individual abbreviated dataset is performed independently of the amount of available bandwidth via the communications transceiver.

3. The vehicle event recorder system of claim 1, wherein transmission of the particular individual abbreviated dataset is performed instantly.

4. The vehicle event recorder system of claim 1, further comprising one or more vehicle systems transducers configured to generate output signals conveying vehicle usage information, the one or more vehicle systems transducers forming at least part of an on-board databus system, the vehicle usage information including information related to one or more of a drive-train of the vehicle, a gear transmission of the vehicle, an engine of the vehicle, brakes of the vehicle, or lights of the vehicle, wherein the physical anomaly event triggers are detected based at least in part on the output signal generated by the one or more vehicle systems transducers.

5. The vehicle event recorder of claim 1, wherein the microprocessor is configured such that the particular individual physical anomaly event trigger is associated with one or more of a vehicle accident, swerving, or hard braking.

6. The vehicle event recorder of claim 1, wherein the captured image data includes video images associated with a prescribed moment in time, wherein the prescribed moment corresponds to the particular individual physical anomaly event trigger, and wherein the captured image data includes video images captured prior to and after the prescribed moment in time.

7. The vehicle event recorder of claim 1, wherein the microprocessor is configured to facilitate transmission of one or more of the particular individual detailed complete dataset or the particular individual abbreviated dataset via the communications transceiver to the server computer responsive to electronic requests originating from the server computer.

8. The vehicle event recorder system of claim 1, wherein the detailed complete datasets include a first detailed complete dataset and a second detailed complete dataset, wherein the first detailed complete dataset corresponds to a first physical anomaly event trigger, wherein the second detailed complete dataset corresponds to a second physical anomaly event trigger, wherein the first detailed complete dataset includes more bytes of data than the second detailed complete dataset, wherein the abbreviated datasets include a first abbreviated dataset and a second abbreviated dataset, wherein the first abbreviated dataset corresponds to the first detailed complete dataset, and wherein the second abbreviated dataset corresponds to the second detailed complete dataset.

9. The vehicle event recorder system of claim 8, wherein the microprocessor is configured to facilitate transmission of the first abbreviated dataset instantly via the communication network upon creation of the first abbreviated dataset, wherein the microprocessor is configured to facilitate transmission of the second abbreviated dataset instantly via the communication network upon creation of the second abbreviated dataset, wherein the microprocessor is configured to facilitate transmission of the first detailed complete datasets responsive to the amount of available bandwidth being sufficient to permit transmission of the first detailed complete dataset, and wherein the microprocessor is configured to facilitate transmission of the second detailed complete datasets responsive to the amount of available bandwidth being sufficient to permit transmission of the second detailed complete dataset.

10. The vehicle event recorder system of claim 1, further comprising a vehicle system transducer configured to detect occurrences of events during use of the vehicle, wherein the physical anomaly event triggers are based on the detected occurrences of events.

11. The vehicle event recorder system of claim 1, wherein the electronic memory includes managed loop memory and buffer memory, wherein the microprocessor is configured to effectuate storage of captured image data in the managed loop memory, and wherein the microprocessor is further configured to transfer, responsive to the physical anomaly event triggers, the captured image data from the managed loop memory to the buffer memory.

12. The vehicle event recorder system of claim 11, wherein the microprocessor is configured to effectuate storage of the abbreviated datasets in the buffer memory, and wherein the communications transceiver is configured to transmit information from the buffer memory via the communication network to the server computer.

13. The vehicle event recorder system of claim 1, wherein the microprocessor is configured to create the abbreviated datasets through compression of the detailed complete datasets.

14. The vehicle event recorder system of claim 1, wherein transmission of the individual one of the abbreviated datasets via the communications transceiver is performed wirelessly.

15. The vehicle event recorder system of claim 1, further comprising the server computer configured to receive transmission from the communications transceiver.

16. A method for transmitting information from a vehicle event recorder system associated with a vehicle to a server computer that is remotely located from the vehicle, the vehicle event recorder system including a video camera, a communications transceiver, an electronic memory, and a microprocessor, the method comprising:

capturing image data by the video camera, wherein the image data is captured using a field of view arranged to include an environment in and/or around the vehicle;

effectuating storage of captured image data in the electronic memory;

responsive to a particular individual physical anomaly event trigger, creating a particular individual detailed complete dataset that corresponds to the particular individual physical anomaly event trigger, wherein the particular individual detailed complete dataset includes image data captured by the video camera;

creating a particular individual abbreviated dataset by parsing the particular individual detailed complete dataset such that the particular individual abbreviated dataset corresponds to the particular individual physical anomaly event trigger, wherein the particular individual abbreviated dataset includes less bytes of data than the particular individual detailed complete dataset;

effectuating storage of the particular individual abbreviated dataset in the electronic memory;

facilitating transmission of the particular individual abbreviated dataset without delay via the communication network; and

subsequently to the transmission of the particular individual abbreviated dataset, and responsive to the amount of available bandwidth being sufficient to permit transmission of the particular individual detailed complete dataset, facilitating transmission of the particular individual detailed complete dataset via the communication network.

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